CORRELATED STUDIES OF CELLULAR INTERACTIONS USING TEM, FREEZE ETCHING, AND SEM

EMS (1974).

J. P. Revel

Division of Biology, California Institute of Technology, Pasadena, CA 91109

Movement of individual cells or of cell sheets and complex patterns of folding play a prominent role in the early developmental stages of the embryo. Our understanding of these processes is based on three-dimensional reconstructions laboriously prepared from serial sections, and from autoradiographic and other studies. Many concepts have also evolved from extrapolation of investigations of cell movement carried out *in vitro*. The scanning electron microscope now allows us to examine some of these events *in situ*. It is possible to prepare dissections of embryos and even of tissues of adult animals which reveal existing relationships between various structures more readily than used to be possible without an SEM. By combining cinematographic observations with scanning electron microscopy of the same samples and with freeze-cleaving and other techniques, one can now get a more complete picture of the relationship between the structure of the cell surface, the internal structure of the cell membrane and the behavior of the cells. We will describe data on cellular movements and interaction obtained by correlating observations made *in vivo*, in the SEM and by freeze etching.

References:

1. Revel, J. P.: Scanning Electron Microscopy/IITRI 541 (1974).
2. Revel, J. P., P. Hoch and D. Ho: Exptl. Cell Res. March (1974) in press.
3. Revel, J. P., P. Yip and L. L. Chang: Develop. Biol. 35, 320 (1973).
4. Miller, M. M. and J. P. Revel: Scanning Electron Microscopy/IITRI 549 (1974).

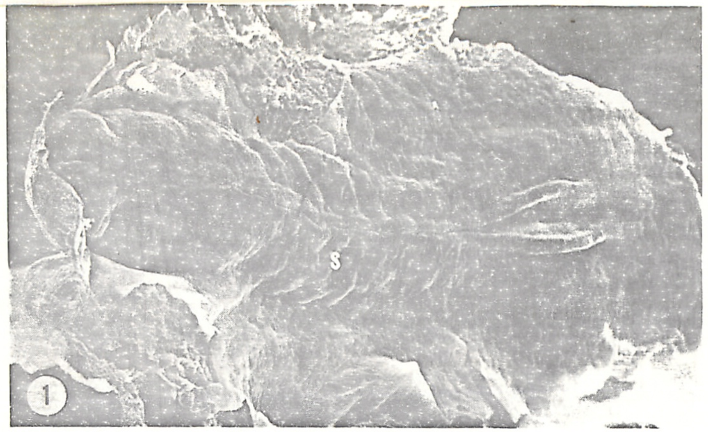
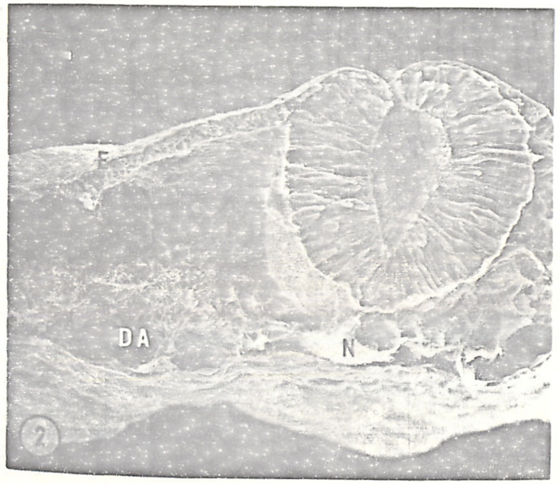


Fig. 1. A chick embryo at stage 8 seen in the scanning E. M. The two anterior bulges represent the prosencephalon (PE). The neural tube is still incompletely closed at the level of the somites (S). Near the posterior end one can see the sinus rhomboidalis where the edges of the neural plate have not yet been approximated. This embryo was fixed in glutaraldehyde followed by osmium and was then critical point dried from Freon 13.



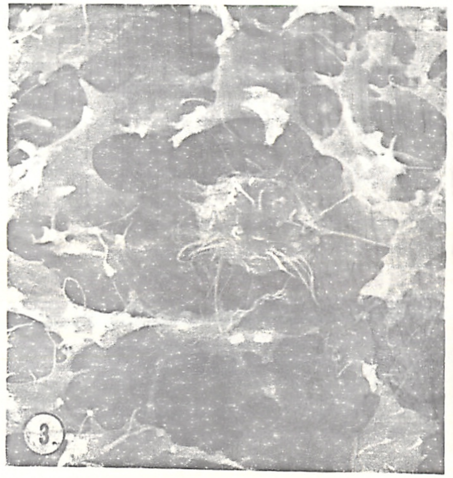


Fig. 2. The same embryo fractured along line a-a' reveals internal structures. The relationship of the ectoderm (E) and the notochord (N) with the neural tube can be seen, as well as the elongated shape of the cells in the neural tube. The outside surface of a somite, and the dorsal aortae (DA) can be seen.

Fig. 3. A higher power view of cells in the lateral mesoderm in a young chick embryo. The "stellate" shape of the mesenchymal cells is clearly visible, and one can appreciate the large number of contacts these cells have with each other. The cell in the middle of the field has rounded up preparatory to division. It remains attached to its neighbors by numerous slender processes, the "retraction" fibrils.